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Original Article

Oral probiotics in acne vulgaris: A narrative review of randomized trials and clinical implications

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ABSTRACT

Background: Acne vulgaris is a common inflammatory skin disorder affecting adolescents and adults and is associated with significant psychosocial impact. Concerns regarding antibiotic resistance have increased interest in adjunctive therapies such as probiotics. **Materials and Methods:** A structured literature search was conducted using PubMed, Scopus, and Web of Science to identify randomized controlled trials published up to December 2024 evaluating oral probiotics in acne vulgaris. **Results:** Four randomized controlled trials were included. Probiotic supplementation, used alone or in combination with systemic antibiotics, was generally associated with modest improvement in inflammatory lesion counts and acne severity. Greater benefit was observed when probiotics were used as adjunctive therapy. **Conclusions:** Oral probiotics may provide modest short-term benefit in mild-to-moderate inflammatory acne and are well tolerated. However, current evidence remains limited by small sample sizes, heterogeneity of probiotic formulations, and short follow-up duration.

Key words: Acne vulgaris; Probiotics; Randomized controlled trials; Gut–skin axis; Inflammation

INTRODUCTION

Acne vulgaris is one of the most common inflammatory skin disorders worldwide, affecting up to 85% of adolescents and frequently persisting into adulthood [1,2]. Although often considered a self-limited condition, acne may follow a chronic or relapsing course and is associated with impaired quality of life, anxiety, and depressive symptoms. Long-term sequelae, including scarring and post-inflammatory dyspigmentation, contribute to significant psychosocial burden and may lead to lasting cosmetic and psychological effects [1].

The pathogenesis of acne is multifactorial and involves follicular hyperkeratinization, increased sebum production, colonization by Cutibacterium acnes, and activation of inflammatory pathways [1,3]. In recent years, inflammation has been recognized as an early and central event in acne development rather than a secondary consequence of follicular obstruction. Activation of innate immune pathways, including toll-like receptor signaling, leads to the production of pro-inflammatory cytokines such as interleukin-1β and interleukin-17, promoting neutrophilic infiltration and Th17-mediated immune responses [4,5]. These processes contribute to the formation and progression of inflammatory lesions and highlight the importance of therapies targeting immune dysregulation in addition to microbial factors.

Current management strategies include topical retinoids, benzoyl peroxide, topical and systemic antibiotics, hormonal therapies in selected patients, and oral isotretinoin for severe or refractory disease [3]. Systemic antibiotics, particularly doxycycline and minocycline, remain widely used for moderate inflammatory acne; however, prolonged use is associated with increasing concerns regarding antimicrobial resistance and disruption of the normal microbiome [3,6]. In addition,

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antibiotic-related adverse effects and the potential impact on gut microbial balance have raised further concerns regarding long-term use. These challenges have intensified interest in adjunctive therapeutic strategies that may reduce reliance on antibiotics while maintaining clinical efficacy.

In this context, oral probiotics have emerged as a potential adjunctive approach due to their immunomodulatory properties and their proposed role within the gut–skin axis [7,8]. The gut–skin axis describes bidirectional interactions between intestinal microbiota, epithelial barrier integrity, systemic immune responses, and cutaneous inflammation. Alterations in gut microbial composition have been hypothesized to influence systemic inflammatory signaling and immune regulation, potentially affecting skin homeostasis and inflammatory skin diseases, including acne vulgaris [7–10]. Probiotic supplementation may modulate cytokine production, improve barrier function, and reduce systemic inflammation; however, these effects appear to be strain-specific and context-dependent.

Despite increasing interest, the clinical effectiveness of oral probiotics in acne remains controversial. Variability in probiotic strains, dosing regimens, study populations, and outcome measures has resulted in heterogeneous findings across clinical trials. Moreover, the lack of standardized protocols and limited number of high-quality randomized controlled trials complicate interpretation and translation into clinical practice.

While previous reviews have examined the role of probiotics in dermatologic conditions, acne-specific randomized evidence remains limited and clinically variable [11]. A focused evaluation of randomized controlled trials is therefore necessary to provide a clearer understanding of the potential benefits and limitations of probiotic therapy in acne vulgaris.

The aim of this review is to summarize and critically appraise randomized controlled trials evaluating oral probiotics in acne vulgaris and to discuss their potential role as adjunctive therapy in clinical practice.

MATERIAL AND METHODS

A structured literature search was conducted using PubMed/MEDLINE, Scopus, and Web of Science to identify relevant studies published up to 31 December 2024. The search strategy included combinations of the following terms: "acne vulgaris", "probiotics", "Lactobacillus", "Bifidobacterium", and "randomized controlled trial".

The study selection process followed a structured screening approach, including duplicate removal, title and abstract screening, and full-text eligibility assessment, as illustrated in Figure 1 [12]. Records identified through database searching were screened for duplicates, followed by title and abstract screening. Potentially eligible studies underwent full-text assessment for inclusion.

Eligible studies were limited to human randomized controlled trials evaluating oral probiotic supplementation in patients with clinically diagnosed acne vulgaris. Included studies were required to report objective clinical outcomes, such as inflammatory lesion counts or validated acne severity indices.

Exclusion criteria included non-randomized studies, observational studies, case reports, reviews, animal studies, studies evaluating only topical probiotics, and studies lacking objective clinical outcome measures.

Data extraction was performed for study design, sample size, probiotic strains, treatment regimens, duration of therapy, and reported clinical outcomes. Any discrepancies in study selection or data interpretation were resolved through discussion and consensus among the authors.

Reference lists of included studies were manually screened to identify additional relevant publications not captured in the initial database search.

RESULTS

A total of four randomized controlled trials published between 2010 and 2024 met the predefined inclusion criteria [13–16] as summarized in Table 1. Sample sizes ranged from 28 to 80 participants, with the majority of studies enrolling patients with mild-to-moderate acne vulgaris. Across studies, participants were generally adolescents or young adults, although detailed demographic characteristics were variably reported.

Two trials evaluated oral probiotic supplementation as monotherapy compared with placebo [13,14], while two studies assessed probiotics as adjuncts to systemic antibiotic therapy [15,16]. The duration of treatment ranged from 8 to 12 weeks in all included

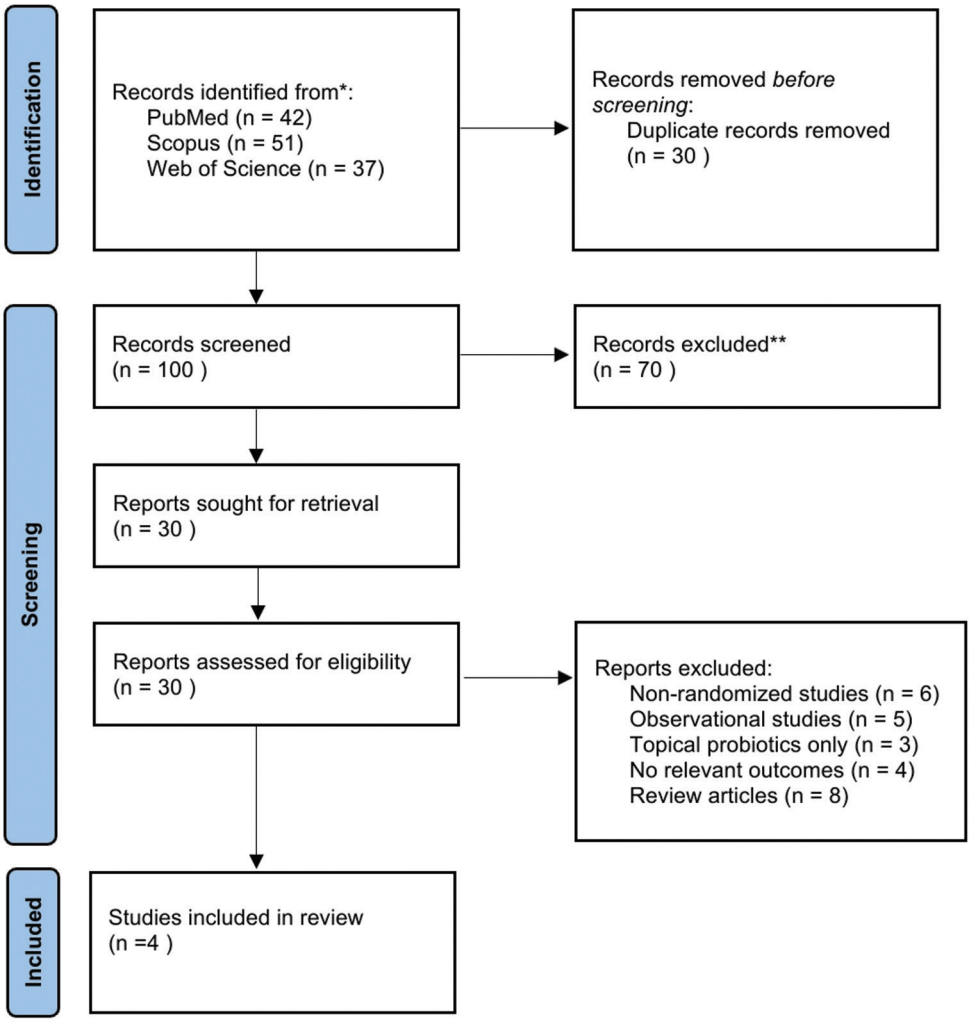
Identification
Records identified from*:
PubMed (n = 42)
Scopus (n = 51)
Web of Science (n = 37)
Records removed *before screening*:
Duplicate records removed (n = 30)
Screening
Records screened (n = 100)
Records excluded** (n = 70)
Reports sought for retrieval (n = 30)
Reports assessed for eligibility (n = 30)
Reports excluded:
Non-randomized studies (n = 6)
Observational studies (n = 5)
Topical probiotics only (n = 3)
No relevant outcomes (n = 4)
Review articles (n = 8)
Included
Studies included in review (n =4)

Figure 1: Flow diagram of study selection process.

Table 1: Summary of randomized controlled trials of oral probiotics in acne vulgaris

Study	Country	Intervention	Comparator	Duration	Key findings
Kim *et al.* [13]	South Korea	Lactobacillus plantarum CJLP55	Placebo	12 weeks	Reduction in acne severity indices compared with placebo
Eguren *et al.* [14]	Spain	Lacticaseibacillus rhamnosus (CECT 30031) + Arthrospira platensis (BEA_IDA_0074B)	Placebo	12 weeks	Improvement in acne severity scores compared with placebo
Jung *et al.* [15]	Canada	Probiotic+minocycline	Minocycline alone	12 weeks	Greater clinical improvement with adjunctive probiotics compared with antibiotic monotherapy
Atefi *et al.* [16]	Iran	Probiotic + doxycycline	Doxycycline alone	8 weeks	Greater reduction in inflammatory lesion counts compared with antibiotic alone

RCT – randomized controlled trial.
Duration represents treatment period reported in each study

trials. Outcome measures included inflammatory lesion counts, total lesion counts, and validated acne severity indices, although specific scoring systems varied between studies.

In placebo-controlled trials, Kim et al. [13] evaluated Lactobacillus plantarum CJLP55 in a double-blind randomized design and reported a reduction in acne severity indices compared with placebo over a 12-week period. Similarly, Eguren et al. [14] evaluated an oral probiotic formulation and demonstrated improvement in acne severity scores during the treatment period.

In studies evaluating adjunctive therapy, Jung et al. [15] conducted a prospective randomized trial comparing minocycline alone versus minocycline combined with probiotic supplementation. The combination group demonstrated greater improvement in clinical

parameters compared with antibiotic monotherapy. Atefi et al. [16] evaluated probiotic supplementation in combination with doxycycline and reported a greater reduction in inflammatory lesion counts compared with antibiotic therapy alone.

Across all included trials, probiotic supplementation was associated with improvement in inflammatory lesion counts and/or acne severity indices compared with control interventions [13–16]. Although the magnitude of improvement varied among studies, the direction of effect was consistent across independent populations and study designs.

Improvements were predominantly observed in inflammatory lesions, while effects on non-inflammatory comedonal lesions were limited or not consistently reported. Clinical responses were generally observed within 8 to 12 weeks of treatment initiation.

No study reported significant losses to follow-up that affected interpretation of results. Probiotic supplementation was well tolerated across all trials, with no serious treatment-related adverse events reported [13–16]. Mild gastrointestinal symptoms were infrequent and occurred at rates comparable to control groups.

DISCUSSION

This review synthesizes randomized controlled trial evidence evaluating oral probiotics in acne vulgaris and highlights their potential role as an adjunctive therapeutic strategy. Across the included studies, probiotic supplementation was generally associated with improvement in inflammatory acne outcomes, particularly when used in combination with systemic antibiotics [15,16]. Although the magnitude of effect varied among studies, the direction of effect was consistent across studies.

The observed clinical effects are most likely related to modulation of inflammatory pathways rather than direct antimicrobial activity. This interpretation is supported by the predominance of improvement in inflammatory lesions rather than non-inflammatory comedones. Activation of innate immune signaling pathways in acne, including toll-like receptor-mediated responses, leads to increased production of pro-inflammatory cytokines such as interleukin-1β and interleukin-17, which contribute to lesion development. Probiotic supplementation has been proposed to influence these pathways through immune modulation, regulation of host–microbiome interactions, and effects on the gut–skin axis [7–10,17,18-20]. However, these mechanisms remain incompletely defined and are likely to be strain-specific, which may partially explain variability in clinical outcomes.

The findings of this review are consistent with previous systematic evaluations suggesting a potential role for probiotics in inflammatory skin diseases [11]. However, earlier reviews often included heterogeneous dermatologic conditions or non-randomized evidence. By focusing specifically on randomized controlled trials in acne vulgaris, the present review provides a more targeted and clinically relevant synthesis of higher-level evidence. Nevertheless, the limited number of available trials and their methodological variability continue to constrain definitive conclusions.

A key challenge in interpreting the current evidence is the heterogeneity of probiotic formulations. The included trials evaluated different bacterial strains and combinations, including Lactobacillus plantarum, Lacticaseibacillus rhamnosus, and mixed formulations with Arthrospira platensis. Given that probiotic effects are strain-specific, these differences limit generalizability and prevent identification of an optimal probiotic regimen. In addition, variations in dosing, treatment duration, and outcome measures further complicate direct comparison between studies [19,21].

Another important limitation is the relatively short duration of follow-up in available trials, which restricts evaluation of long-term efficacy and relapse prevention. Acne is a chronic relapsing condition, and short-term improvements may not necessarily translate into sustained clinical benefit. Furthermore, most studies have focused on patients with mild-to-moderate acne, and evidence in severe disease remains limited. The absence of data on long-term outcomes and relapse rates represents a critical gap in the current literature.

From a clinical perspective, probiotics may be considered as an adjunctive option in selected patients with inflammatory acne, particularly in those receiving systemic antibiotic therapy. This approach is relevant within the context of antibiotic stewardship, where strategies that support clinical improvement while potentially reducing antibiotic exposure are of increasing interest [18,21]. In addition, probiotic supplementation may be considered in patients experiencing gastrointestinal intolerance associated

with antibiotic use or in those seeking complementary approaches within evidence-based care. However, probiotics should not be considered a replacement for established first-line therapies.

Overall, the role of probiotics in acne management should be interpreted as supportive rather than disease-modifying. Their incorporation into clinical practice should be individualized and guided by current evidence limitations.

Practical Clinical Considerations

Probiotic supplementation may be considered in patients with mild-to-moderate inflammatory acne receiving systemic antibiotics, in those requiring prolonged or repeated antibiotic therapy, or in individuals experiencing gastrointestinal intolerance during antibiotic use. It may also be appropriate for patients seeking adjunctive or complementary strategies within evidence-based acne management.

Probiotics should not be used as standalone treatment in severe acne, particularly nodulocystic disease requiring isotretinoin, or in situations requiring rapid clinical control. Established first-line therapies remain the cornerstone of management.

There is currently no standardized probiotic regimen for acne vulgaris. Commonly studied strains include Lactobacillus plantarum, Lacticaseibacillus rhamnosus, and Bifidobacterium species. Doses in clinical studies typically range from 10^8 to 10^{10} colony-forming units per day, with treatment durations of 8–12 weeks [13–16]. Given strain-specific effects, clinical outcomes cannot be generalized across all probiotic formulations.

Patients should be counseled that probiotics may provide modest improvement in inflammatory lesions, particularly when used alongside standard therapies. Clinical benefits are not immediate and generally require several weeks of use. It is important to emphasize that current evidence remains limited and that individual responses may vary.

Future Directions

Future research should focus on adequately powered, multicenter randomized controlled trials using standardized outcome measures and clearly defined probiotic strains. Comparative studies evaluating different strains, dosing strategies, and treatment durations would be particularly valuable in clarifying optimal therapeutic approaches. In addition, longer-term studies are needed to assess durability of response, relapse rates, and potential effects on antibiotic use. Further investigation into mechanistic pathways may also help identify patient subgroups most likely to benefit from probiotic supplementation.

CONCLUSIONS

This review of randomized controlled trials indicates that oral probiotics may provide modest short-term improvement in inflammatory acne, particularly when used as adjunctive therapy with systemic antibiotics. Probiotic supplementation appears to be well tolerated; however, available evidence is limited by small sample sizes, heterogeneity of probiotic formulations, and short follow-up duration.

Accordingly, probiotics should be considered complementary rather than replacement therapy within established acne management strategies. Further well-designed randomized controlled trials with standardized outcomes and longer follow-up are required to clarify optimal probiotic regimens and their long-term clinical role.

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Ethical Approval

This study is a narrative review of previously published data and did not involve human participants or animals; therefore, institutional ethical approval was not required.

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